ORDER

6850.32

PRECISION APPROACH PATH INDICATOR WITH REMOTE MONITORING SUBSYSTEM (PAPI WITH RMS) FA-10265 PROJECT IMPLEMENTATION PLAN

JUNE 27, 1990

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Distribution: A-W(NC/NN/NW/SM/LG/VN/AS/SE)-3; A-W(FS/TR)-2; A-X(AF/AS/AT/FS)-3; A-FAF-2/7(LTD); A-Y(DE/AY)-3; A-Z-1; ASM-400(4); ASM-600(4)

Initiated By: ANN-140

RECORD OF CHANGES

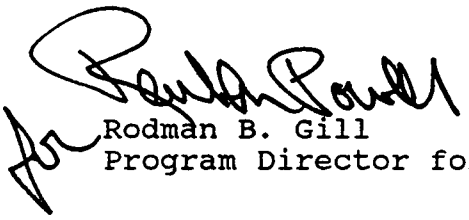
DIRECTIVE NO. 6850.32

CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE

GPO 1968 OF 308-183

FOREWORD

This order provides management direction for the implementation and acceptance of the Precision Approach Path Indicator (PAPI) System with Remote Monitoring Subsystem (RMS) into the National Airspace System (NAS). It defines the major functional responsibility levels, management direction, and overall program guidance to all responsible levels within the FAA for the procurement and implementation of the PAPI with RMS.



Rodman B. Gill
Program Director for Navigation and Landing

TABLE OF CONTENTS

CHAPTER 1. GENERAL

1. PURPOSE. This project implementation plan (PIP) provides technical guidance and direction for implementing the Precision Approach Path Indicator (PAPI) System with Remote Monitoring Subsystem (RMS) into the National Airspace System (NAS).

2. DISTRIBUTION. This order is distributed to branch level to the Program Directors for Communications, Navigation and Landing, and Weather and Flight Service Systems; the NAS System Engineering, Systems Maintenance, and Logistics Services; Aviation Standards National Field Office, Office of Airport Standards; to division level in the Flight Standards and Air Traffic Plans and Requirements Services; to branch level in the regional Airway Facilities (AF), Airports, Air Traffic, and Flight Standards divisions; to the Director, FAA Technical Center, to branch level in the FAA Depot and FAA Academy at the Mike Monroney Aeronautical Center; and limited distribution to the Airway Facilities General NAS sectors, sector field offices, sector field units, and sector field office units.

3. AUTHORITY TO CHANGE THIS ORDER. The Program Director for Navigation and Landing (ANN) shall approve all changes to this order.

4.-19. RESERVED.

CHAPTER 2. PROJECT OVERVIEW

20. SYNOPSIS. As a result of the FAA's examination of the current airport visual navaids system and determination to comply with International Civil Aeronautics Organization (ICAO) standards, the concept of a PAPI system has been developed. The PAPI program consists of procuring the equipment specified in FAA-E-2756, Four-Box Precision Approach Path Indicator, and installing and integrating the system as part of a visual aids establishment program.

21. PURPOSE. The purpose of the PAPI project is to provide vertical visual guidance to the pilot. The PAPI project will provide an international standard PAPI system.

22. HISTORY.

a. After examination of many different visual glidepath systems in cooperation with the ICAO, the FAA adopted the PAPI as the national standard for a visual glidepath system.

b. The specification FAA-E-2756 was baselined, project budgeted, and set aside for an 8a contractor. The first contractor selected to build the PAPI was Sonicraft, Inc., of Chicago, Illinois. The contract was let October 15, 1985, and equipment deliveries were made through 1989 and 1990.

c. On Sept 29, 1988, a new contract, DTFA01-88-Y01051 was awarded to AVW Corporation of El Segundo, California, for another 100 PAPI systems. The PAPI equipment to be delivered under this contract is the subject of this order.

23.-29. RESERVED.

CHAPTER 3. PROJECT DESCRIPTION

30. FUNCTIONAL DESCRIPTION. The PAPI system (figure 3-1) will consist of four lamp housing assemblies (LHA) and a power and control assembly (PCA). Its function will be to provide the pilot visual descent guidance to the runway during a nonprecision approach.

a. Lamp Housing Assembly. Each of the four lamp housing assemblies will be set at a slightly different angle (20 minutes apart) and will emit a beam of high-intensity light, the upper half showing red and the bottom half showing white. As seen by the approaching pilot, the PAPI system will appear as a bar of four quick transition red/white light units whose on-glidepath signal (usually 3 degrees) is two red and two white lights. When the aircraft is slightly below glidepath (between 2 degrees, 50 minutes and 2 degrees, 30 minutes), the signal will change to three red and one white light. When the aircraft is further below the glidepath (below 2 degrees, 30 minutes), a fly-up signal of four red lights will be seen. Conversely, deviations above the glidepath will cause the outputs of the light units to appear to turn successively white. See figure 3-2 for PAPI system signal presentations.

b. Power and Control Assembly. Control of the PAPI will be available from the Tower Control Computer Complex (TCCC) at those Airport Traffic Control Towers (ATCT) so equipped. At non-TCCC ATCT's, control will be provided through the Remote Radio Control System (RRCS) and aircraft Very High Frequency/Ultra High Frequency (VHF/UHF) radio (part time ATCT's only). The region shall have the option of using conventional control lines if that option is more practical. The PCA contains the input circuitry required to operate the PAPI system. The PCA also supplies power for the PAPI system at two light intensity steps, one for daytime operation and one for night operation. The intensity of the lights is controlled by photoelectric circuitry.

c. Remote Monitoring Subsystem. The PAPI will have an RMS function built-in which will monitor current, voltage, tilt switch, on/off status. The interface with the PAPI RMS will be an RMS concentrator (RMSC) or Maintenance Processor Subsystem (MPS). In addition to providing equipment status and alarm information for maintenance purposes, operational status of the lights will be determined and provided to the TCCC. Should the airport be unmanned and control transferred to the TCCC, operational status information will be provided to the TCCC via the Remote Maintenance Monitoring System (RMMS) while operational control will be given directly to the pilot through use of the

aircraft VHF transmitter.

d. Aiming Instrument and Calibration Bar.

(1) Clinometer. An FAA approved clinometer will be used to accurately adjust the LHA during cross-leveling (lateral), longitudinal leveling, and elevation setting.

(2) Calibration Bar. A calibration bar is provided by the PAPI manufacturer to permit field checking and calibration of the clinometer provided with the PAPI.

FIGURE 3-1. FUNCTIONAL RELATIONSHIP OF PAPI UNITS

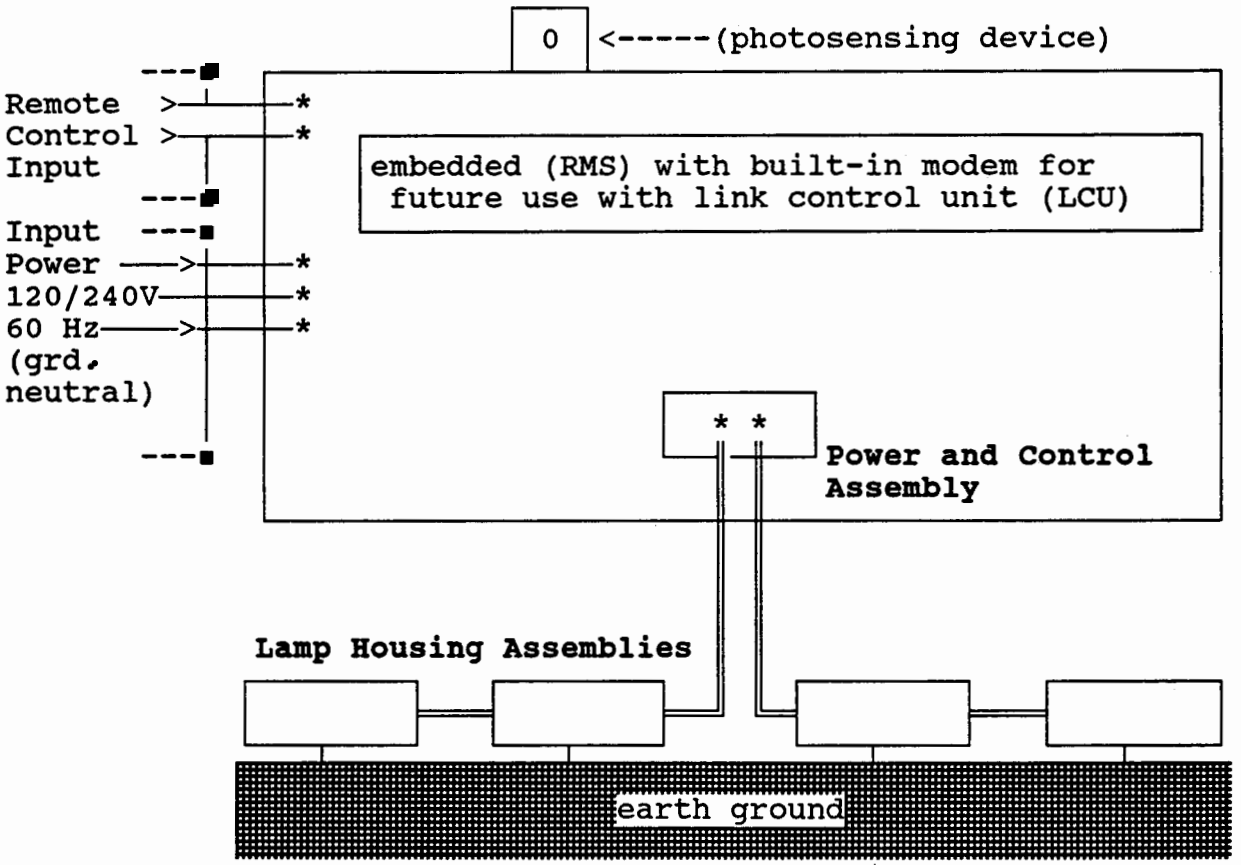
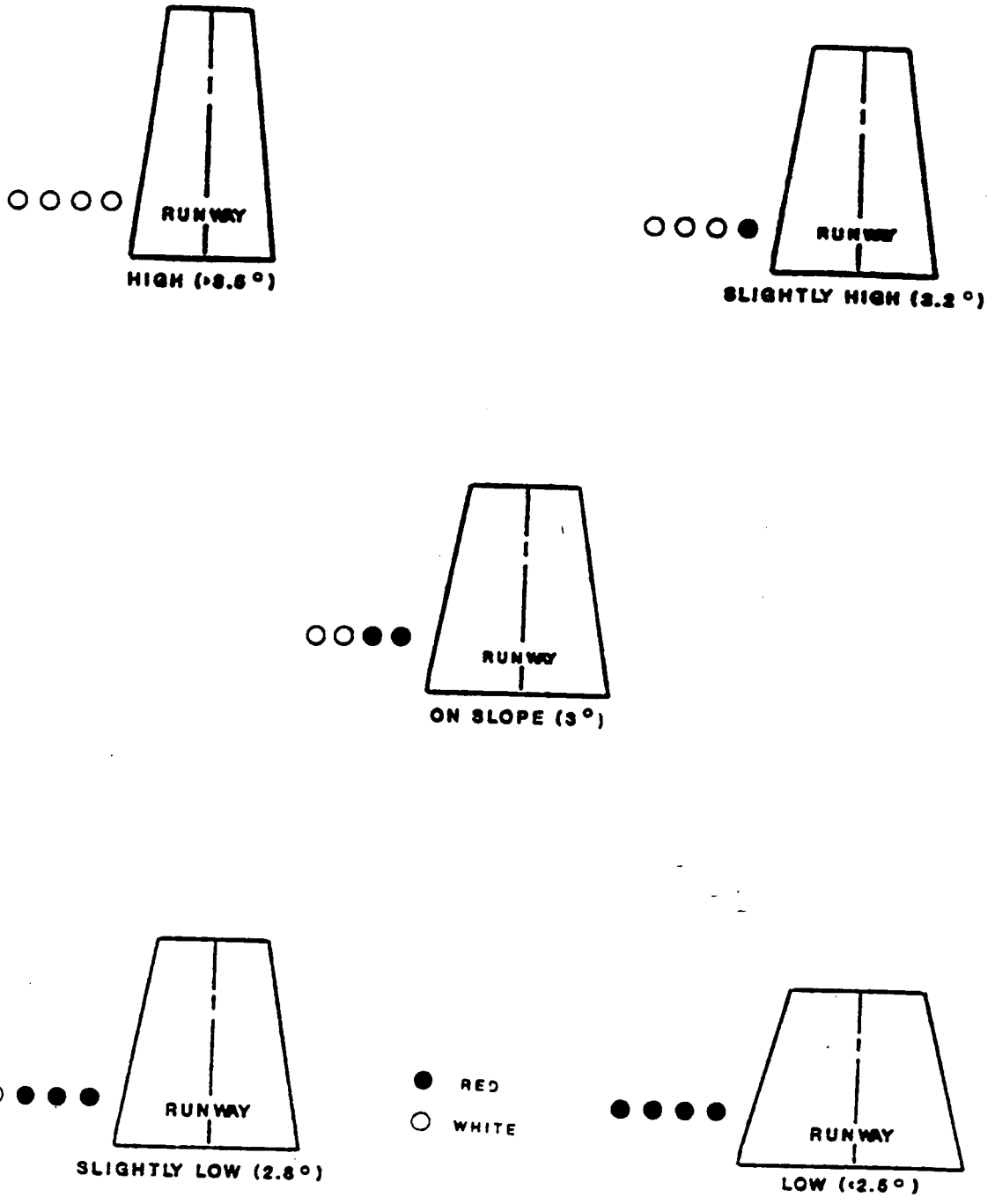


FIGURE 3-2. PAPI SYSTEM SIGNAL PRESENTATIONS



31. PHYSICAL DESCRIPTION.

a. Lamp Housing Assembly. The PAPI system consists of four LHA's each containing three lamps and filters. The four light units will be arranged in a bar perpendicular to and on the left side of the runway and facing the approach end of the runway. The PAPI optical system is set by the manufacturer and no additional adjustment, other than aiming the LHA's, is required. The LHA's (figures 3-3 and 3-4) are installed on a rigid mounting base with three adjustable legs, with frangible couplings, to permit aiming of the light beam to any vertical angle from horizontal to up to 6 degrees. In addition the mounting and adjustment hardware permit transverse leveling where any mounting leg may be up to one inch higher or lower than any other leg after installation. Within the LHA, the lamp mounting assembly permits firm and positive positioning of three easily replaceable, PAR-64 lamps, or equal, using seating lugs. Each of the three vertical planes formed by the three lamp seating lugs is perpendicular to the optical bench center line within +/-1 minute of arc. Focusing of the optical system is accomplished by adjusting the seating lugs. Three red filter assemblies, with a transmittance of at least 15 percent when lamps are operated at full intensity, are supplied with each LHA. In addition three projection lenses, recessed under an overhang to minimize direct impingement or splash-back of rain or snow on the lenses, are mounted in a vertical frame at the front of the LHA. A terminal block rated to carry 10 amperes at 250 VAC is provided at the rear of the LHA along with terminal blocks for signal wiring. The entire LHA excluding lamps and mounting legs weighs 86 pounds.

b. Power and Control Assembly. The PCA is a compact, lightweight (50 pounds), self-cooled unit installed on frangible couplings behind the LHA furthest from the runway edge. The PCA is contained in a cabinet which contains all the power and control components, including terminal blocks, cable clamps, grounding lugs, and protective devices. In addition, the cabinet contains the photoelectric switching circuitry to control light intensity and a rotatable photosensing device mounted on the top surface of the cabinet. A current control device provides a constant rms load current through the lamps of the LHA's and an elapsed time indicator is installed to register the number of hours of operation at the high intensity setting. A panel-mounted true rms output current meter for series mounted lamps in the LHA's and a power supply to supply proper voltages and currents to operate the PCA are also contained within the cabinet.

FIGURE 3-3. LAMP HOUSING ASSEMBLY (SIDE VIEW)

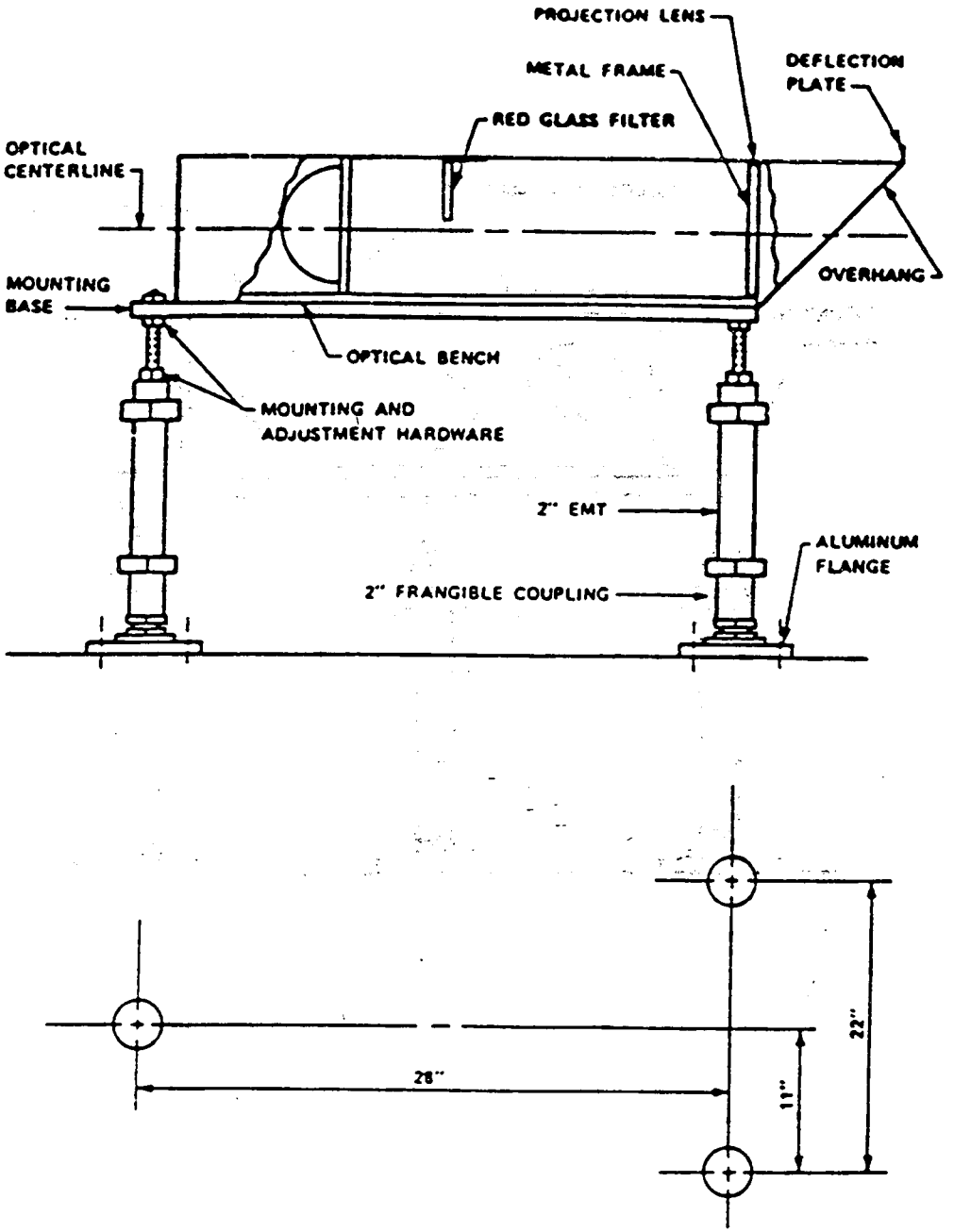
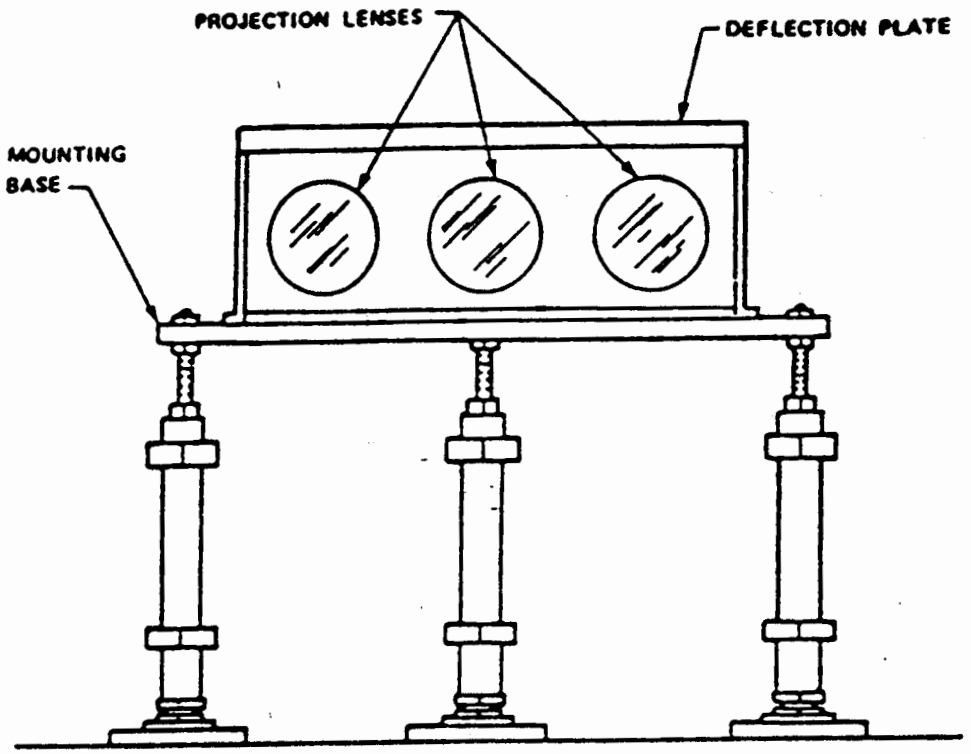


FIGURE 3-4. LAMP HOUSING ASSEMBLY (FRONT VIEW)



c. Remote Monitoring Subsystem. The RMS is contained within the PCA and provides test points for all signals required to be monitored during checkout, alignment, calibration and/or during preventive maintenance. Test point controls and indicators are mounted on printed wiring boards and are accessible without the removal of components, modules, or circuit cards. Test points and controls are terminated in a central location within the equipment cabinet and are easily accessible from the front of the circuit cage assembly without the use of extender boards. Test points and controls are connected to the RMMS through a RS-232c plug connector. A built-in modem is provided as an interface to the RMMS.

d. Aiming Instrument Set and Calibration Bar.

(1) Clinometer. The clinometer is a lightweight, rugged aluminum instrument. It has an accurate, direct-reading digital liquid crystal display for setting the LHA to the desired angle from 0.0 to 6.0 degrees.

(2) Calibration Bar. The calibration bar is a stiff, hard aluminum bar that is designed for laying on a flat surface and that provides adjustment features to permit it to be leveled to a horizontal plane.

32. SYSTEM REQUIREMENTS. PAPI system requirements include power, space, electromagnetic interference, and environmental considerations. Reliability, maintainability, and interchangeability are also design considerations of the system.

a. Power Requirements. Power requirements for the PAPI are outlined in Order 6950.2C, Electrical Power Policy Implementation National Airspace System Facilities. The PAPI system operates on a single phase, 60 Hz, 120/240VAC grounded-neutral power source. In addition, the RMS utilizes a 2-hour back-up battery power source to maintain operation during an ac power interruption. The lamp load consists of six 200 watt, PAR-64, or equal, 6.6A lamps in each of the two wire output circuits. The system is designed to suppress switching transients, and to withstand transient increases superimposed on the 120/240VAC rms power line input voltage that reach a peak value of 500 volts for as long as 50 milliseconds. In addition, the equipment is designed to withstand lightning transients superimposed on each input power line.

b. Siting. The PAPI must be sited and aimed so that it

defines an approach path with adequate clearance over obstacles and a minimum threshold crossing height. If the runway has an electronic landing system glide slope already established, the PAPI is installed so that the visual glidepath angle will coincide with the electronic glide slope. When an electronic glide slope is not present, one must determine a position and an aiming for the PAPI which will produce the required threshold crossing height and clearance over obstacles in the area. Generally, the PAPI is installed in the configuration depicted in figure 3-5. Order 6850.2A, Visual Guidance Lighting Systems, dated December 17, 1981, cites the siting criteria.

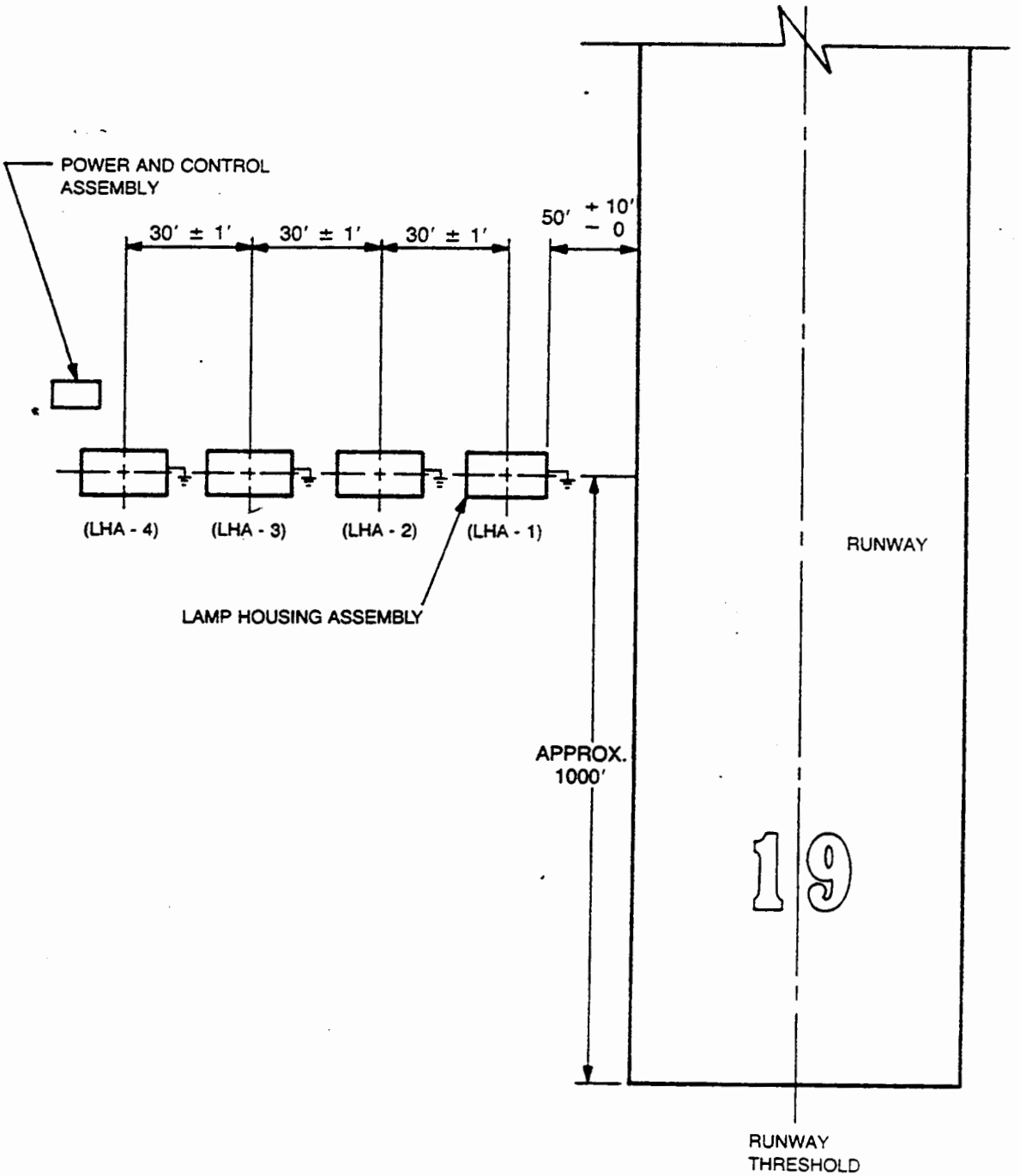
c. Electromagnetic Interference. Conducted interference levels on incoming ac power leads, control leads, and signal leads shall not exceed the limits for CE03 as defined in MIL-STD-461 for its equipment classification. Radiated emission over the frequency range of 30 kHz to 400 MHz, at a distance of 20 feet, shall not exceed the limit for RE02 of MIL-STD-461.

d. Reliability. Mean time between failure (MTBF) of the system, except for lamps and the RMS, is not less than 2,500 hours. A system failure is defined as occurring when output tolerances from the PCA are exceeded, or when intensity step control is malfunctioning, or when components of the PCA cause the LHA's to cease operation. The MTBF for the RMS is not less than 30,000 hours.

e. Maintainability. The PAPI system shall have a mean time to repair (MTTR) of not more than 20 minutes with no single restoration exceeding 3 hours in duration. Mean periodic maintenance time (MPMT) for the PAPI system shall not exceed 2 hours per 3 months, including routine inspection. These values are established based upon the fact that each PAPI site will be outfitted with a one for one spare Line Replaceable Unit (LRU) in accordance with the current PAPI maintenance concept.

f. Interchangeability. All parts of the unit furnished under a single procurement will be manufactured to a tolerance that permits interchangeability of any part with a like part of any other unit.

FIGURE 3-5. PAPI SYSTEM CONFIGURATION



33. INTERFACES. The PAPI system has the capability of being monitored by the RMMS described in FAA-E-2782, Remote Maintenance Monitoring System, Core System/Segment Specification, when provided. Its other remote maintenance interfaces have not yet been defined although the PAPI will interface through existing Link Control Units (LCU) with the Maintenance Control Center (MCC) and with the TCCC (where installed). The PAPI shall also be interfaced with the RRCS described in specification FAA-E-2723 and in Order 6850.2A.

a. Remote Maintenance Monitoring System. Interfacing of the LCU with the RMS units and the MPS is normally accomplished via the use of the built-in modems and the Government furnished equipment (GFE) radio links. The link control unit will be provided with a UHF radio link operating in the 406 to 420 MHz band. The frequencies assigned for the radios are site dependent. Therefore, it is imperative that any proposed changes to PAPI locations be initiated as soon as possible to place the proper radio at the correct site at minimal cost. Other interface criteria are described in the remainder of this paragraph.

(1) The MPS interface is designed in accordance with EIA Standard RS-232 wired as a synchronous data terminal equipment (DTE), duplex, type D interface. The MPS interface is wired to a rear mounted female MIL-C-24308 (MS 18725) connector. The data rate across the MPS interface shall be 2400 bytes per second (bps).

(2) The LCU and the RMS terminal interfaces are both designed in accordance with EIA Standard RS-232, wired as asynchronous data interfaces, use even parity, and automatically adjust to the following baud rates: 110, 150, 300, 1200, 2400, 4800, and 9600. The terminal interface is wired to a front panel mounted female connector, MS 18725, in accordance with MIL-C-24308. ASCII characters received via the terminal interface shall also be transmitted, i.e., echoed, as the characters are received.

(3) Normally the data interface between the LCU and each equipment RMS is a half-duplex, 2400 bps, multipoint data radio link. However, provision to operate via a point-to-point, half-duplex, two-wire phone line is also available by means of wirestrapping. Minimum phone line quality in this configuration shall be 3002 (AT&T Tariff FCC-260) per Bell System Technical Reference Publication 41004, or equivalent. Since AT&T FCC-260 has been replaced by AT&T Tariffs 9, 10, and 11, the current line

equivalent is channel type 5 conditioned C-2 with protocol type NO of AT&T Publication 43202. The line may be unconditioned (basic) if the modems can still transmit 2400 bps at an acceptable bit error rate. Order 6000.22, Maintenance of Two-Point Private Lines, is scheduled to be updated to provide guidelines for required line characteristics to remove dependence on the AT&T standard.

(4) In addition to the interface characteristics described in this paragraph, the LCU will also be capable of interfacing with the RMS in accordance with EIA Standard RS-232 wired as a synchronous, DTE, duplex, type D interface. The DTE interface shall have the capability to utilize either the built-in modem for transmission or an external modem meeting the requirements of FED-STD-1005 (except paragraphs 2.2 and 2.4 and associated subparagraphs). Data rates across the DTE interface shall be programmable to 2400, 4800, 9600, and 19,200 bps.

b. Remote Control Interface Unit. The remote control interface unit provides the PAPI system with connectivity to two external remote control systems. One of these, the RRCS described in FAA-E-2723, provides control of the PAPI system to an operator in the ATCT. The other, described in Advisory Circular AC 150/5345-49A, Specification L-854, Radio Control Equipment, provides control of the PAPI system at an unattended facility to the pilot via an air-to-ground (A/G) receiver. The remote control interface unit is not provided with the PAPI system and must be purchased separately if required.

c. Remote Monitoring Subsystem. The PAPI RMS consists of voltage and current sensors, cabling, connectors, the mounting hardware necessary to route required samples of signals and control functions to the mounted units of the PAPI RMS, and a data acquisition system. The data acquisition system consists of a dc power supply, a terminal interface for use with a portable terminal, a Voltage Monitoring Equipment (VME) bus interface card cage, and provisions for interface with a GFE radio link for communication with an LCU.

d. Link Control Unit. The LCU consists of a dc power supply, a GFE radio operating in the UHF band, a VME bus interface card cage, and three data links. The three data links consist of a MPS interface, the LCU to equipment RMS's multipoint data link, and the terminal interface. The LCU is designed such that the capability of interfacing the LCU with up to 10 PAPI RMS's can be expanded with the installation of an expansion kit. The expansion kit, when installed, expands the LCU capability

such that the LCU has the capacity for interfacing with up to 20 PAPI's or other relatively low data rate systems with RMS's at the same airport location.

e. Tower Control Computer Complex. The TCCC will provide a to be determined (TBD) interface to the PAPI.

34.-39. RESERVED.

Chapter 4. PROJECT SCHEDULE AND STATUS

40. PROJECT SCHEDULES AND GENERAL STATUS. The procurement to fulfill FY-86/87 requirements is for 100 PAPI equipment to be delivered to the FAA Depot under the provisions of contract DTFA01-88-Y-01051 from a new contractor, AVW Corporation.

41. MILESTONE SUMMARY SCHEDULE. The current project schedule is shown in table 4-1. Project events are scheduled in relationship to the date of contract award. The dates listed are for those milestones completed or anticipated. This table is by no means an all inclusive list of project milestones necessary for project completion.

42. INTERDEPENDENCIES AND SEQUENCE. Deliveries of systems to the FAA Depot are scheduled to began in December 1990. The following projects were identified as having interdependencies with the PAPI project. Because of the broad variation in site requirements, discussion of specific effects of each program on a site-by-site basis is beyond the scope of this PIP.

a. The Airport Cable Loop Program. The Airport Cable Loop Program establishes a network with all of the airport's power and control cables. The PAPI will precede the Airport Cable Loop Program at some locations which might lead to their being dropped from control cable loops, although power cable loops may still be required.

b. The Airport Telecommunications Program. The Airport Telecommunications Program will establish the specifications and criteria for a reliable and flexible distribution system for low activity and medium activity airports. The Airport Telecommunications Program is related to all airport projects which require buried cable for control signals or communications between sites. The Airport Telecommunications Program investigates frequency interference and alternative communications media within the NAS Plan. The PAPI impacts this program only in the landing area since the PAPI does require some buried cable for the system to function.

c. The Remote Maintenance Monitoring System. The RMMS program has been developed to provide maintenance monitoring and control equipment for FAA facilities so that performance monitoring, certification, and control could be accomplished from centralized work centers. In some cases the RMMS program may not be fully implemented until some time after installation of the PAPI system has been completed. In these situations, the

reduction in the frequency of onsite maintenance visits derived from the integration of the PAPI RMS with the RMMS may not be realized until some time after the PAPI has been installed. The RMMS program will have to be considered on a case-by-case basis for each air facility affected.

43.-49. RESERVED.

TABLE 4-1. MILESTONE SUMMARY SCHEDULE

EVENT	DATE
Contract Award	9/29/88
Master Test Plan Approved	7/27/90
Shakedown Test Plan Approved	8/17/90
Integration Test Plan Approval	8/17/90
First System Delivery to T&E Site	8/30/90
Finish System Integration & Checkout	10/19/90
Finish Integration & Shakedown Tests	11/08/90
First System Delivery FAA Depot	12/31/90
Last System Delivery FAA Depot	6/10/91

CHAPTER 5. PROJECT MANAGEMENT

50. PROJECT MANAGEMENT, GENERAL. This chapter describes the organizations with the Program Director for Navigation and Landing that are directly responsible for PAPI program management.

a. Program Director for Navigation and Landing (ANN-1). The Program Director for Navigation and Landing manages, directs, and executes the FAA's engineering and management activities related to facilities design, air navigation, landing aids, and air traffic control facilities and equipment to ensure that the NAS is efficient, economical, and responsive to operational needs.

b. Program Management Engineering Division (ANN-100). This division is the principal element of the service responsible for the design, development, and implementation of systems, programs, and facilities requirements for navigation and landing systems.

c. Visual Aids Engineering Branch (ANN-140). The Visual Aids Engineering Branch is the principal element of the division responsible for design, development, and implementation responsibilities for approach lighting and visual range systems.

d. PAPI System Program Manager. The PAPI Program Manager is supported by engineering and is responsible for managing the design, development, and implementation activities associated with the PAPI with RMS. His/her duties include:

(1) Management. Planning, scheduling, and managing the program from design through commissioning, logistics support, training, and program completion. Responsible for systems engineering, system design, man-machine interface, component design and related functional, technical, and performance characteristics. Acts as chairman of the National Airspace Integrated Logistics Support (NAILS) Management Team (NAILSMT).

(2) Logistic Support. Providing, in conjunction with the NAILSMT, the technical guidance to define the logistics support requirements for proper logistics management and support of the PAPI with RMS.

(3) Modernization Input. Developing service input for the modernization or in-service improvement of equipment.

(4) Technical Officer. Providing engineering advice and consultation to contracting officer during procurement, serving as technical officer, and reviewing contractor requests and progress payments.

(5) Cost Data. Developing and providing cost data, controlling assigned funds, and adjusting program schedules and objectives as necessary.

(6) Technical Installation Instructions. Preparing technical installation instructions and standard drawings.

(7) Maintenance Instructions. Preparing maintenance instructions, identifying training, provisioning and test requirements, and directing the preparation of technical instruction books (FAA-D-2494/b) and suggested changes to the maintenance technical handbooks.

(8) Testing. Reviewing and approving manufacturers' equipment test procedures. Establishing requirements and approving plans for test and evaluation of engineering activities of the FAA Technical Center.

(9) Inventory. Managing in-transit materiel for construction and installation. Maintaining currency of materiel systems and control over equipment inventory.

(10) Installation. Managing installation activities for current and future systems to assure a high level of system performance.

(11) Acceptance. Providing research, engineering, development, design, and systems analyses associated with acquisition and acceptance of hardware and software.

51. PROJECT CONTACTS. This paragraph lists PAPI project contacts and their addresses.

(a) Cluster Manager. Rod Gill, ANN-1, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591, FTS 267-6531, (202) 267-6531.

(b) Program Manager. Charles B. Ochoa, ANN-140, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591, FTS 267-6600, (202) 267-6600.

(c) Project Engineer. Arthur Prigal, ANN-140, Federal

Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C., 20591, FTS 267-6576, (202) 267-6576.

52. PROJECT COORDINATION. The PAPI with RMS project requires coordination with other services within the FAA, with regional representatives and with the contractor onsite representative during installation. Coordination by and with the organizations in subparagraphs a. through n. is essential for them to efficiently accomplish their functions.

a. Maintenance Engineering Division (ASM-100). ASM-100 reviews procurement specifications to ensure the design meets the reliability and maintainability requirements and supports the general maintenance philosophy. ASM-100 also coordinates the development of an integrated logistic support plan for the PAPI system acquisition and develops maintenance standards and plans for implementation of maintenance concepts.

b. Maintenance Operations Division (ASM-200). ASM-200 participates in the development and review of maintenance plans. In addition, ASM-200 develops national Airway Facilities sector staffing standards for the PAPI program and validates maintenance staffing requirements. The program manager ensures the project is in conformance with staffing, training, certification policies, guidelines, and requirements.

c. Spectrum Engineering Division (ASM-500). ASM-500 obtains frequency authorizations necessary to satisfy the requirements of the NAS. This division also provides engineering support to regional and field facilities in the resolution of and prevention of radiofrequency interference to NAS facilities.

d. National Engineering Field Support Division (ASM-600). ASM-600 provides support in the development of test plans and procedures for site-specific requirements. ASM-600 will conduct all testing and analyze the results of the tests and recommend actions needed to correct deficiencies.

e. NAS Support Division (ALG-200). ALG-200 develops, recommends, and issues agency systems, procedures, standards, and policies for material, supply, and property management. This division also develops the required logistics policies, plans, and standards required to support the NAILS process.

f. Contracts Division (ALG-300). ALG-300 performs cost/price analyses of contractor's proposals and participates as a member of the Source Evaluation Board on PAPI with RMS

procurement subject to the contracting officer. In addition, ALG-300 provides procurement support for the PAPI programs and plans, and places, and administers contracts for the PAPI with RMS equipment. ALG-300 also designates a contracting officer (CO) who is responsible for all contractual matters. The CO is the only individual authorized to approve contract changes impacting price, delivery, or schedule.

g. Industrial Division (ALG-400). ALG-400 performs factory inspection of the PAPI with RMS. ALG-400 assigns a quality/reliability officer (QRO) at the time the contract is awarded. The QRO is the FAA's representative at the contractor's facility and is responsible for verifying quality control. The QRO is directed by FAA policy and procedure and by the terms and conditions of the contract.

h. FAA Depot (AAC-400). AAC-400 accepts deliveries of PAPI systems from the manufacturer and manages the dissemination of PAPI systems at the regions' request. AAC-400 is responsible for logistics support.

i. FAA Academy (AAC-900). AAC-900 provides maintenance training and coordinates with ASM-200 in the development of a training plan. A system user guide will be provided for the training of air traffic personnel.

j. Airway Facilities Training Program Division (AHT-400). AHT-400 analyzes training proposals prepared by ASM-200 and initiates action to meet training requirements in a timely manner.

k. Flight Standards Service Planning and Program Management Branch (AFS-12). AFS-12 manages the prioritization and validation of equipment and facilities for the PAPI program.

l. FAA Aviation Standards National Field Office. The FAA Aviation Standards National Field Office is responsible for providing the coordination to accomplish the following functions:

(1) Providing the support necessary for accomplishing the preliminary (preparatory) and commissioning flight inspections, as specified in the PAPI Master Test Plan.

(2) Determining if the operational status of a facility or system is in accordance with the established tolerances.

(3) Certifying the facility or system for operational

use in the NAS when all operational requirements have been met.

m. FAA Regional Offices. The FAA regional offices through established administrative structures coordinate with all responsible parties to assure adequate funding, establish system commissioning/service availability dates, assign project field representatives, and determine utility availability for the PAPI system. The regions also provide field engineering as required to support preparations for the installation of the PAPI system and the installation of RRCS equipment to monitor/control the visual aids; order Government Furnished Materials (GFM) for tools and test instruments to support installation and acceptance; tailor installation drawings to be site specific; initiate work orders and travel authorization; and assign field personnel. If air-to-ground radio control equipment is required, the region will purchase the unit. The following regional offices are responsible for the coordination required to accomplish the functions listed in subparagraphs (1) through (5).

(1) Regional Airway Facilities Division.

(a) Installing facilities systems and equipment in accordance with established standards, specifications, and instructions. The initial review and approval of installation drawings will be accomplished during the shakedown testing at the designated test site. Upon completion of this testing, final installation standards will be provided to the regions.

(b) Notifying the appropriate sector that a project has been funded and issuing a projected implementation schedule.

(c) Providing the sector an opportunity to review and participate in project plans during the engineering phase and for furnishing the sector a copy of the engineering plans and contract documents.

(d) Submitting NAS Change Proposals (NCP) whenever the PAPI will not be installed in accordance with existing installation handbook, aviation standards, or the NAS System Specification.

(e) Providing the sector a copy of the project work order at least 10 working days before the start of project work.

(f) Providing the appropriate facility reference

data file (FRDF) information to the sector for inclusion in the FRDF.

(g) Providing the essential facility, system, and equipment technical reference and performance parameters as part of the project transmittal when maintenance technical handbook parameters are not available.

(h) Ensuring that all modifications, Configuration Control Documents (CCD), manufacturer's field changes, and factory changes are current and documented for equipment received from sources outside the Airway Facilities sector.

(i) Notifying the joint acceptance board chairman of when the facility will be ready for Joint Acceptance Inspection (JAI), providing the sector all data necessary to prepare warranty failure reports on items failing prior to JAI, supporting the preparation of the FRDF, and providing regional Airway Facilities division representatives for participation in the JAI.

(j) Establishing and maintaining a follow-up file for monitoring and clearing all JAI report exceptions, reviewing all JAI reports and follow-up reports for accuracy, completeness, and proper distribution, taking appropriate and timely actions to clear JAI report exceptions, and identifying additional sources of funds or initiating budgetary action, as necessary, to clear exceptions.

(2) Regional Airports Division.

(a) Coordinating the identification of each PAPI system on the airport sponsor's approved layout plan (ALP) in accordance with the requirements of section 511(a)(15) of the Airport and Airway Improvement Act.

(3) Airway Facilities Sector.

(a) Reviewing contract documents and engineering plans during the engineering phase and providing comments to the regional Airway Facilities division.

(b) Providing personnel as required at appropriate times throughout the project to witness and/or participate in construction, installation, tuneup, tests, and collection of technical reference data.

(c) Coordinating the release of equipment currently in use to regional Airway Facilities division establishment personnel for use in the project.

(d) Maintaining properly those components of an existing facility which are unaffected by an improvement project.

(e) Ensuring that modification/CCD's and documentation are current on installed equipment for the purpose for which the equipment was being used prior to the project.

(f) Providing a representative to serve as the joint acceptance board chairperson and other qualified personnel for participation in the JAI, preparing and distributing the JAI report, and assuming maintenance responsibilities and custodianship for facilities, systems, or equipment at the conclusion of JAI.

(g) Coordinating and followup on exceptions after the JAI to include exceptions assigned to other organizations or to a contractor for clearance, clearing exceptions which have been assigned to the sector, reporting the clearance of exceptions, and reviewing all waived exceptions to determine if actions will impact sector operations or other organizations.

(h) Maintaining all equipment warranty information and reporting equipment failing under warranty.

(i) Receiving, storing, and shipping project materials and disposing of excess equipment and materials.

(j) Preparing and maintaining the FRDF in accordance with Order 6030.45, Facility Reference Data File.

(4) Regional Logistics Division. Providing representatives to participate in specific projects which the regional Airway Facilities division has identified as having major logistical problems and has requested the participation by the regional Logistics division.

(5) Regional Flight Standards Division. Providing technical expertise to the regional Airway Facilities, as required, for accomplishing JAI's and the commissioning of facilities and systems.

n. Contractor. The contractor, when requested by ANN-140 and with the concurrence of the CO, provides engineering support

services for onsite advice, including technical supervision to FAA technicians and the installation contractor concerning proper installation or operation of PAPI with RMS.

53. PROJECT RESPONSIBILITY MATRIX. Figures 5-1 illustrates the FAA organizations responsible for the implementation of each significant function of the PAPI project.

54. PROJECT MANAGERIAL COMMUNICATIONS. The PAPI Program Manager within ANN-140 is the focal point for all internal project communication. Organizations supporting the PAPI Program designate a representative to maintain close communication with the Approach Lighting & Visual Range Program Branch. Supporting organizations maintain communications with both the contractor and internally within the FAA. The meetings listed in subparagraphs a. and b. are the regularly scheduled project meetings or conferences.

a. The National Airspace Integrated Logistics Support Meeting. These meetings are held to ensure that there is an interrelated, unified, and iterative approach to the managerial and technical activities which support the NAS. During these meetings issues effecting NAILS, logistics management, maintenance planning, equipment instruction book development and validation/verification, equipment shakedown testing, supply support, test and support equipment, manpower and training support, support facilities, technical data, and packing, handling, storage and transportation are discussed and resolved. The meetings are held on a semiannual basis at FAA headquarters.

b. Program/Project Status Review Boards. These boards are held on a bimonthly basis at the FAA headquarters to discuss project status and to resolve problems and issues effecting all phases of the project from the time that the requirements are established until system deployment has been completed.

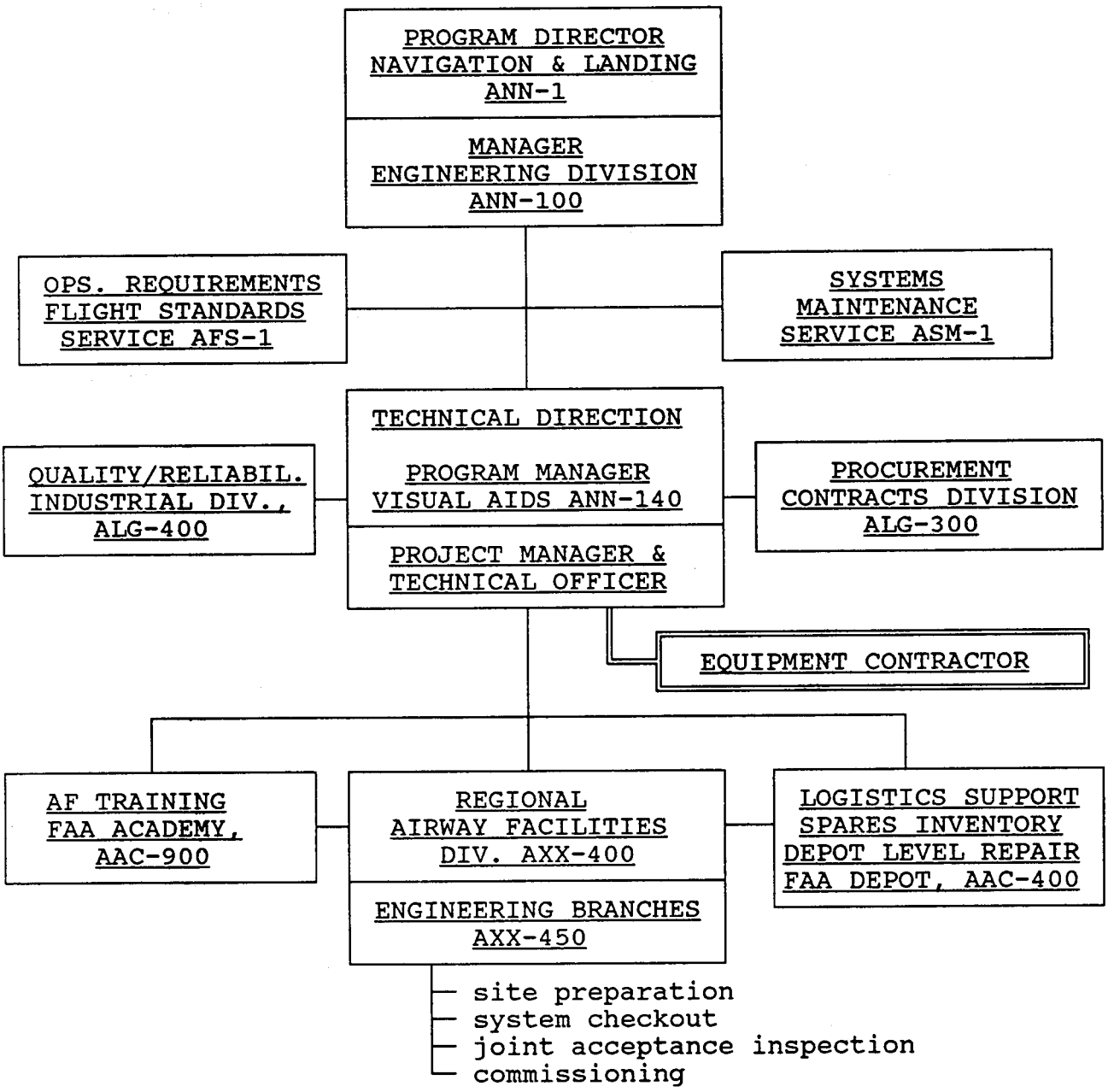
55. IMPLEMENTATION STAFFING. There are no personnel requirements peculiar to the implementation phase of the project.

56. PLANNING AND REPORTS. None required.

57. APPLICABLE DOCUMENTS. Within this PIP the following documents have been referenced:

a. Advisory Circular, AC 150/5345-49A, Specification

FIGURE 5-1 PROJECT RESPONSIBILITY MATRIX



L-854, Radio Control Equipment, August 8, 1986.

b. Contract DTFA01-88-Y-01051, dated September 29, 1988, for PAPI with RMS.

c. FAA-E-2723, Remote Radio Control System, December 21, 1982, with amendment dated May 24, 1985.

d. FAA-E-2750/1, Airport Remote Monitoring System (ARMS), Part I, General Requirements, May 23, 1985.

e. FAA-E-2750/2, Airport Remote Monitoring System (ARMS), Part 2, Link Control Unit, May 23, 1985.

f. FAA-E-2756, Four-Box Precision Approach Path Indicator, February 26, 1985.

g. FAA-E-2782, Remote Maintenance Monitoring System, Core System/Segment Specification, July 14, 1986.

h. FAA-G-2100e, Electronic Equipment, General Requirements, March 11, 1987.

i. Order 1800.8E, NAS Configuration Management, July 11, 1985.

j. Order 1810.4A, FAA NAS Test and Evaluation Program, February 14, 1989.

k. Order 6000.26A, Reliability and Maintainability Policy, May 14, 1982.

l. Order 6030.45, Facility Reference Data File, March 28, 1974.

m. Order 6850.2A, Visual Guidance Lighting Systems, December 17, 1981.

n. Order 6950.2C, Electrical Power Policy Implementation National Airspace System Facilities, November 1987.

o. NAS-DD-1000B, Level I Design Document, May 1986.

p. NAS-MD-110, Test and Evaluation (T&E) Terms and Definitions for the National Airspace System, March 27, 1987.

58.-59. RESERVED.

CHAPTER 6. PROJECT FUNDING

60. PROJECT FUNDING STATUS, GENERAL. Project funding for the PAPI has been provided through FY 92. The current contract was awarded on September 29, 1988, for 100 PAPI systems. Additional requirements will be determined by the urgency of the requirement and the availability of funds.

61.-69. RESERVED.

CHAPTER 7. DEPLOYMENT

70. GENERAL DEPLOYMENT ASPECTS. Deployment of PAPI systems is conducted by the FAA Depot at the Aeronautical Center and the FAA regions. As regional funds become available, requests from the regions to satisfy airport requirements are honored by the FAA Depot. The PAPI with RMS is shipped by the FAA Depot to the site where it is stored for installation. Installation of the equipment is the responsibility of the region. Table 7-1 depicts the PAPI with RMS Deployment Readiness Review (DRR) schedule.

TABLE 7-1. PAPI WITH RMS DRR SCHEDULE

Event	Date
Delivery to T&E Site	8/30/90
Shakedown Testing Complete	11/08/90
Final Rpt. to Assoc. Admin.	12/11/90
Excom Meeting	12/26/90

71. SITE PREPARATION. The regions are responsible for preparing the sites where PAPI equipment will be installed. Site preparation includes planning for installation and integration with the RRCS at both the tower and at the runway location. Considerations for site preparation include weather conditions and concurrent construction activities.

72. DELIVERY. PAPI systems will be shipped to the FAA Depot and will be available to the regions under the constraints of fiscal year funding. The FAA Depot ships equipment to the regions as requests are made and in accordance with the quantities called out in the project status report (PSR). Projected delivery dates are contained in chapter 4. Implementation of the project is scheduled to be completed August 28, 1992.

73. INSTALLATION PLAN. The FAA regions shall coordinate the receipt, installation, and evaluation of all equipment required to form the PAPI system. The PAPI with RMS shall be installed in

accordance with national standard drawings and standards revised to fit the individual site. The regional office shall coordinate the complete installation, alignment, and operational tests on all identified PAPI interfaces to assure full compliance with FAA specifications and performance. The initial review and approval of installation drawings will be accomplished during the shakedown testing at the designated test site. Upon completion of this testing, final installation standards will be provided to the regions. The contractor shall provide engineering support services for onsite advice, including technical supervision to FAA technicians and the installation contractors concerning the proper interfacing of the air-to-ground receiver, RRCS, TCCC, and RMMS to the PAPI with RMS when required. Performance analysis and evaluation reports shall be forwarded to the FAA regional office for acceptance.

74. CONFIGURATION MANAGEMENT PLAN. Configuration Management (CM) is the process used to identify and document the functional and physical characteristics of a configuration item, control changes to those characteristics, and record and report change processing and implementation status. Configuration items of concern for this implementation are the LHA and PCA which contain embedded RMS with interface modem RS-232 ports. The CM discipline shall be applied to all configuration items included in the PAPI with RMS baselines to ensure compatibility between elements within the PAPI with RMS. All additions and changes to the PAPI with RMS baselines shall be proposed in the form of a case file, and shall be reviewed for recommended approval or disapproval by a Configuration Control Board (CCB). All changes to the NAS site design baseline, the LHA's, PCA, and the RMS interface must be processed and approved by the Navigation and Landing (ANN-100) CCB.

a. Acquisition Phase Configuration Management. The Navigation and Landing (ANN-100) CCB controls the establishment of and changes to the PAPI with RMS hardware baselines during the acquisition phase. For PAPI with RMS matters, the ANN-100 CCB will include members from National Airway Engineering Field Support Sector, ASM-600, Spectrum Engineering Division, ASM-500, Communications and Spectrum Branch, ACN-210, Communications/Navigation/Surveillance Division, ACN-200, and the Air Transportation Division, AFS-200. The ANN-100 CCB is responsible for ensuring that the functional, performance, and interface requirements allocated to the PAPI with RMS hardware subsystems are reflected in the baselines, and in any changes to those baselines until product acceptance. The ANN-100 CCB is also responsible for ensuring that baseline documentation is

accurate and reflects PAPI with RMS operational requirements. Baseline documentation includes specifications and interface control documents (ICD) and Interim Monitor and Control Software (IMCS) software. The PAPI will use LCU/MPS IMCS software and modules. The ANN-100 CCB retains this CM responsibility throughout the PAPI life cycle. The transition of configuration management responsibilities associated with PAPI with RMS hardware products occurs at acceptance by the ANN-100 CCB designated representative of the contractor's delivered, installed, integrated, and tested hardware product. Hardware product acceptance is based on successful operational readiness demonstration (ORD) of the complete PAPI system. At product acceptance, the change control functions and CCB records associated with hardware products that effect Level III drawings and instruction books transition from the ANN-100 CCB to the Maintenance Engineering (ASM-100) CCB.

b. Operational Support Phase Configuration Management. During the operational support phase, and for the entire life-cycle of the implemented hardware enhancements, configuration management functions will consist of maintenance and change control management of site as well as product baseline (Level III Design). The ASM-100 CCB assumes baseline and change control management of the LHA, PCA, and the RMS interface hardware products and associated peripherals as each product is commissioned for operational service, via Memorandum of Agreement (MOA), and of related NAS site design baselines (including logistics and training). The ASM-100 CCB is responsible for change control management of the PAPI with RMS hardware product baseline by MOA. Hardware product baselines are maintained by the National Engineering Field Support Division (ASM-600) personnel in the field. The contractor shall provide engineering changes to ASM-600 when the changes are released and prior to field implementation. ASM-600 shall evaluate the changes and approve the change for field implementation via a case file. The CM functions assigned to the ASM-100 CCB are described in the ASM-100 CCB charter.

75.-79. RESERVED.

CHAPTER 8. VERIFICATION

80. FACTORY VERIFICATION. The contractor performs a series of tests in accordance with the requirements of the contract, the equipment specification, FAA-G-2100e, Electronic Equipment, General Requirements, and other documents prior to acceptance of the equipment by the FAA. These tests, design qualification tests, type tests, and production tests will demonstrate that all hardware, software, and all performance requirements are met before the FAA accepts a PAPI system from the contractor.

81. CHECKOUT. Each PAPI will be shipped from the contractor's facility with a complete set of Equipment Instruction Books. After installation of equipment by the regions, FAA personnel will conduct checkout tests in accordance with the contractor developed equipment instruction books. The procedures to be followed will include testing electrical and mechanical hardware interfaces, verifying system performance, testing interfaces through diagnostics, and verifying maintenance capability and adequacy of support hardware and software.

82. CONTRACTOR INTEGRATION TESTING. Not applicable.

83. CONTRACTOR ACCEPTANCE INSPECTION (CAI). Not applicable.

84. FAA INTEGRATION TESTING. These tests are conducted to verify that the PAPI system has been integrated as specified and that it can interface with the specified external systems. Included are tests that verify the operation of multiple interfaces and integration with other systems in the operational environment. At this point in time, the PAPI system should have been adapted to parameters of the operational equipment with which it must interface.

85. SHAKEDOWN AND CHANGEOVER. System shakedown is the critical period of testing that is performed after the FAA takes full responsibility for equipment/systems and software from the equipment manufacturer. Shakedown testing will verify and validate all PAPI system interfaces at each operational site. Evaluations to determine the adequacy and acceptability of procedures and operations to demonstrate an initial operating capability (IOC) shall be accomplished prior to system shakedown. System shakedown ends when JAI activities begin. During system shakedown, tests and checks are conducted on the automated system to verify that it functions properly, meets operational requirements, and is maintainable. System shakedown permits facility personnel to become familiar with the system, learn its

limitations, and to become proficient in diagnosing problems and effecting repairs. Shakedown activities include accomplishment of the following activities:

a. Operational and maintenance proficiency and hands-on training.

b. Evaluations to determine the adequacy of system failure detection and recovery procedures.

c. Live testing of operational functions, including specific adaption data, and system configuration.

d. Evaluations to determine the suitability of displayed operational data.

86. JOINT ACCEPTANCE INSPECTION (JAI). A JAI is conducted in accordance with Order 6030.45 to gain the consensus of the involved office that the PAPI project has been completed in accordance with applicable standards and specifications and that the facilities are capable of providing the services required within established standards and tolerances. The JAI ensures compliance with requirements in the following areas:

a. Facility construction and equipment installation.

b. Facility/system/equipment performance.

c. Facility technical performance documentation and maintenance reference data.

d. Facility logistics support.

e. Final acceptance and commissioning.

87.-89. RESERVED.

CHAPTER 9. INTEGRATED LOGISTICS SUPPORT

90. MAINTENANCE CONCEPT. The maintenance concept for the PAPI system shall consist of both site and FAA Depot repair. Maintenance technicians (either FAA and/or contractor) will replace PAPI with RMS components down to the LRU and may perform limited repair/corrective and preventative maintenance functions as required, onsite. FAA Depot maintenance will consist of receipt and repair/replacement of failed LRU's. These functions can be performed by either the FAA and/or a commercial contractor.

91. TRAINING. The training program for the PAPI system consists of maintenance courses covering the LRU removal/replacement at the site level and component repair at the FAA Depot level, as described in the PAPI Subsystem Training Plan. Projected training requirements by individual work centers/facilities and principal training milestones are included in this training plan. Assignment of training quotas for the regions will be made by ASM-260 for Airway Facilities personnel. Regional engineers will be permitted to audit the training course based upon prior coordination with ASM-260. Initial training of FAA AF and FAA Depot repair personnel will be conducted by the contractor at the contractor's facility. Training courses are developed and conducted for those site and FAA Depot level technicians who perform maintenance on PAPI systems and FAA Academy personnel who will be generating academy resident training courses. Training course graduates will be able to configure the PAPI system for normal operation and system testing using manufacturer's instructions and FAA Handbook Specifications. Site technicians will possess sufficient knowledge to troubleshoot and repair to LRU level and to perform and document all periodic maintenance. FAA Depot level technicians will possess sufficient knowledge to troubleshoot and repair to the component level.

92. SUPPORT TOOLS AND TEST EQUIPMENT. PAPI system support tools and test equipment consist of both site and FAA Depot level support and test equipment, including all common and special tools, as well as any connectors or other interface devices necessary to connect the support equipment to the end item or Unit Under Test (UUT). Site level test equipment is supported at the AF sector office having responsibility for the visual aid facility. FAA Depot level test equipment is supported by the FAA Depot. The contractor will provide a list of the common and special tools, test/support equipment, interface devices and connectors required for maintaining PAPI with RMS equipment at the site level of maintenance. In addition, the current PAPI

contract is being modified to include an interim Contractor Repair Service (CRS). This contract modification will include the delivery of the following items within 60 calendar days after the delivery of the last item of Contract Line Item Numbers (CLIN) of the contract:

a. List of all test equipment required to test the item for each item covered by the CRS, including special test equipment.

b. List of all test fixtures including schematics, parts layout, and parts lists of all test fixtures used to test those items under contract.

c. List of all test interface adapters used with Automatic Test Equipment (ATE) equipment including schematics, parts layout, and parts list.

d. All test documentation, test fixtures, and adapters used for diagnostics and repair are to be delivered to the Government 30 working days after expiration of this contract option.

e. Component level troubleshooting procedures developed for repair of the repairable items and components during this CRS.

NOTE: Special tools, test/support equipment, and/or interface devices required to support the PAPI with RMS will be kept at a minimum. Special tools or test equipment required for initial adjustments (i.e., aiming instrument), testing, and/or maintenance of the PAPI with RMS are provided with the equipment.

93. SUPPLY SUPPORT. The FAA Depot is responsible for providing supply support to the PAPI with RMS in the forms of maintaining inventory records and the master FAA catalog, and interfacing with the Federal Cataloging System.

94. VENDOR DATA AND TECHNICAL MANUALS. Instruction books for the PAPI system are provided by the contractor and reviewed by the FAA prior to acceptance. A complete set of instruction books are provided with each PAPI system that is delivered. Instruction manuals for the FAA Depot-level repair shall be supplied to the FAA Depot. Other technical manuals to be provided by the contractor include, reliability, maintainability documentation, and test procedures, and drawings. In addition, the contractor will provide component-level troubleshooting

the contractor will provide component-level troubleshooting procedures developed for repair of the repairable items and components as part of the CRS contract modification.

95. EQUIPMENT REMOVAL. For systems installed under the Visual Navaids Establishment Program, no equipment removal is required.

96. FACILITIES. Not applicable.

97. EQUIPMENT NOT FURNISHED. The following is a list of equipment that may be required for a PAPI with RMS installation, but these items are not furnished under the PAPI procurement:

a. Frangible couplings.

b. Two-inch (5.08 centimeter) electrical metallic tubing conduit.

c. Portable terminal for local control and monitoring of the airport RMS.

d. UHF radios for RMS and LCU radio links.

e. Interface unit.

f. Any ground-to-ground or air-to-ground radio control equipment required.

NOTE: The equipment in paragraph 97 are entered on the Project PSR List on an as needed basis.

98.-99. RESERVED.